Composition Space Covering Al-Cu-Mg Alloys
With Ancillary Li Additions

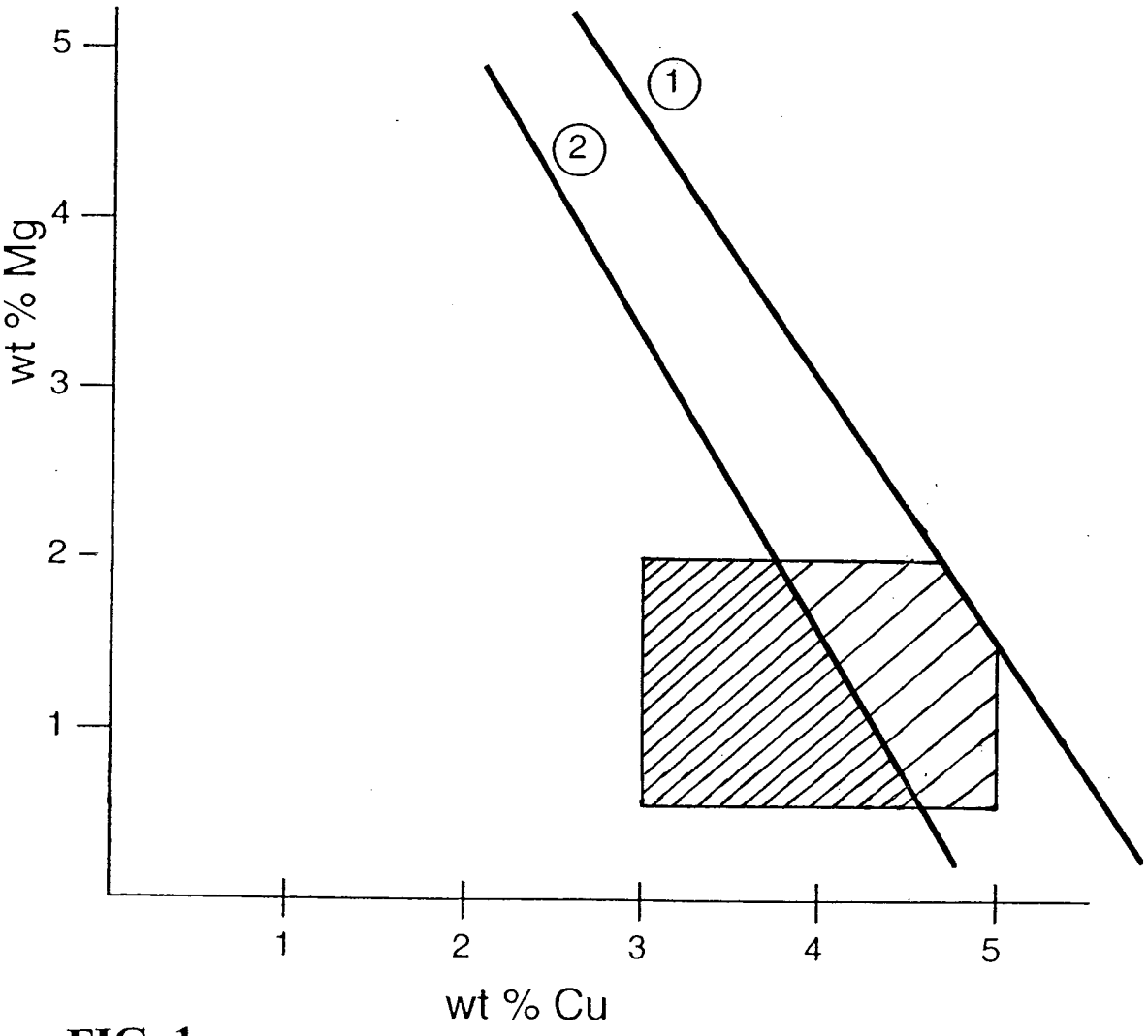

FIG. 1

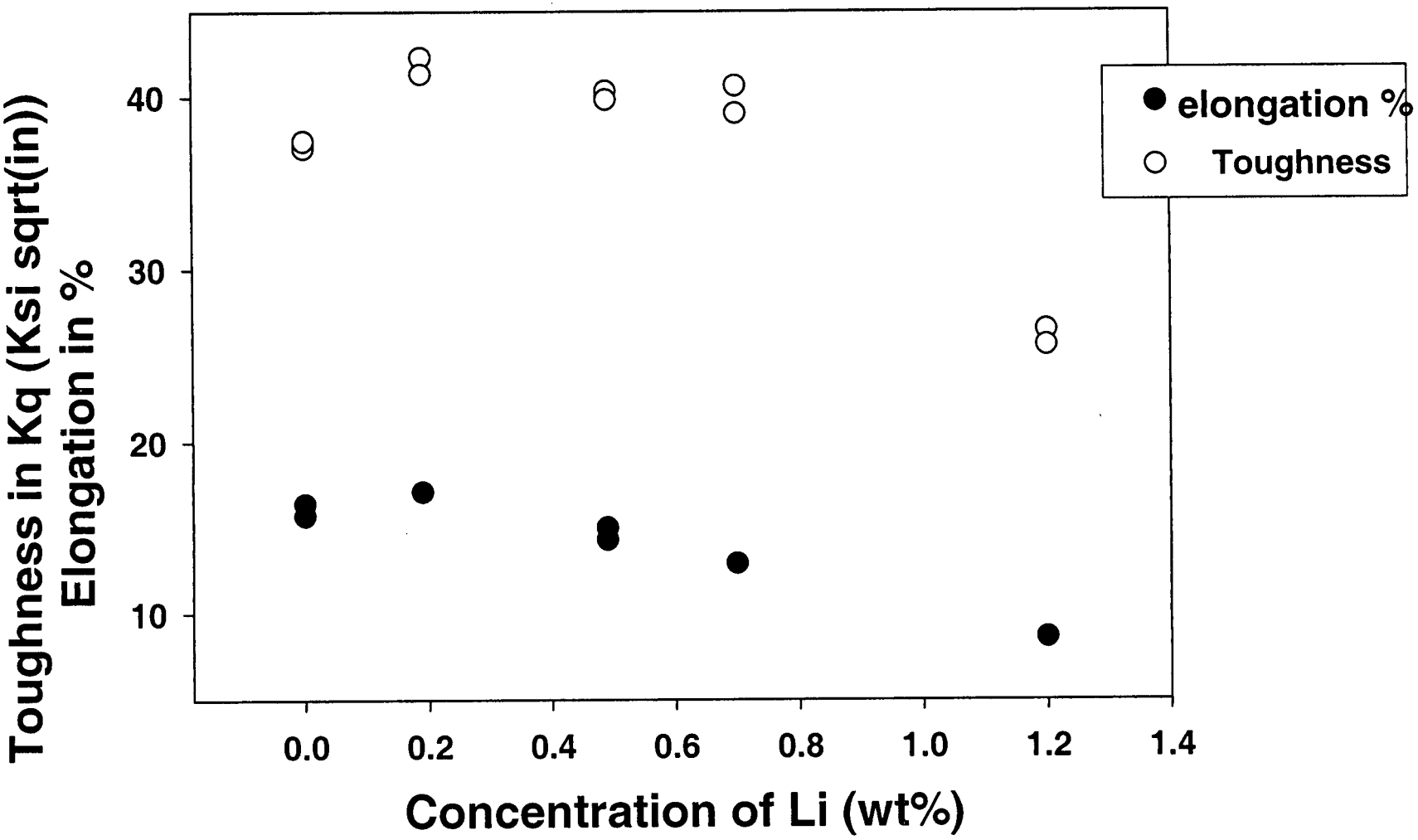
Toughness in Kq (Ksi sqrt(in))
Elongation in %
40
30
20
10
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Concentration of Li (wt%)
elongation %
Toughness

FIG. 2

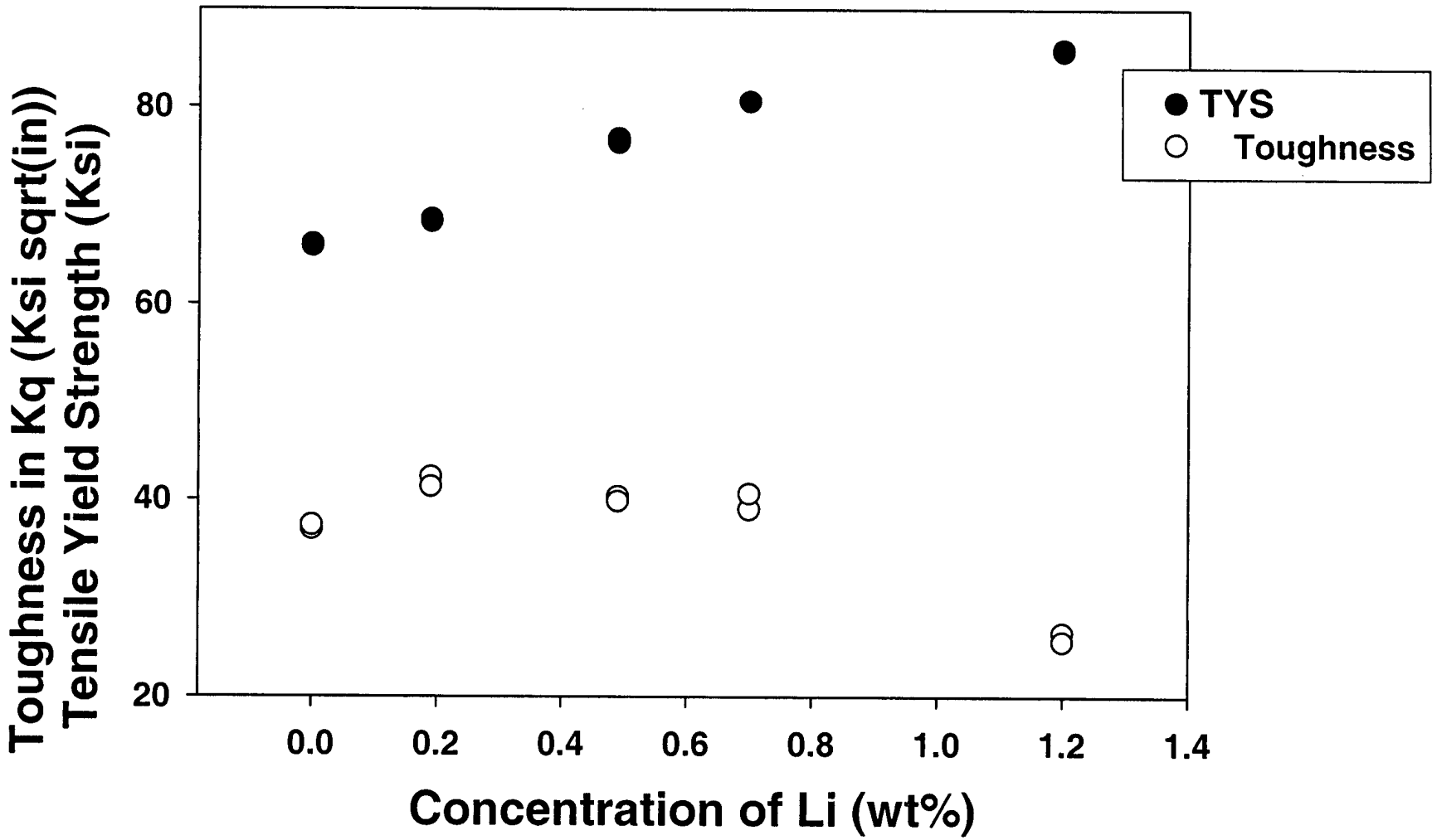
Toughness in Kq (Ksi sqrt(in))
Tensile Yield Strength (Ksi)
80
60
40
20
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Concentration of Li (wt%)
TYS
Toughness

FIG. 3

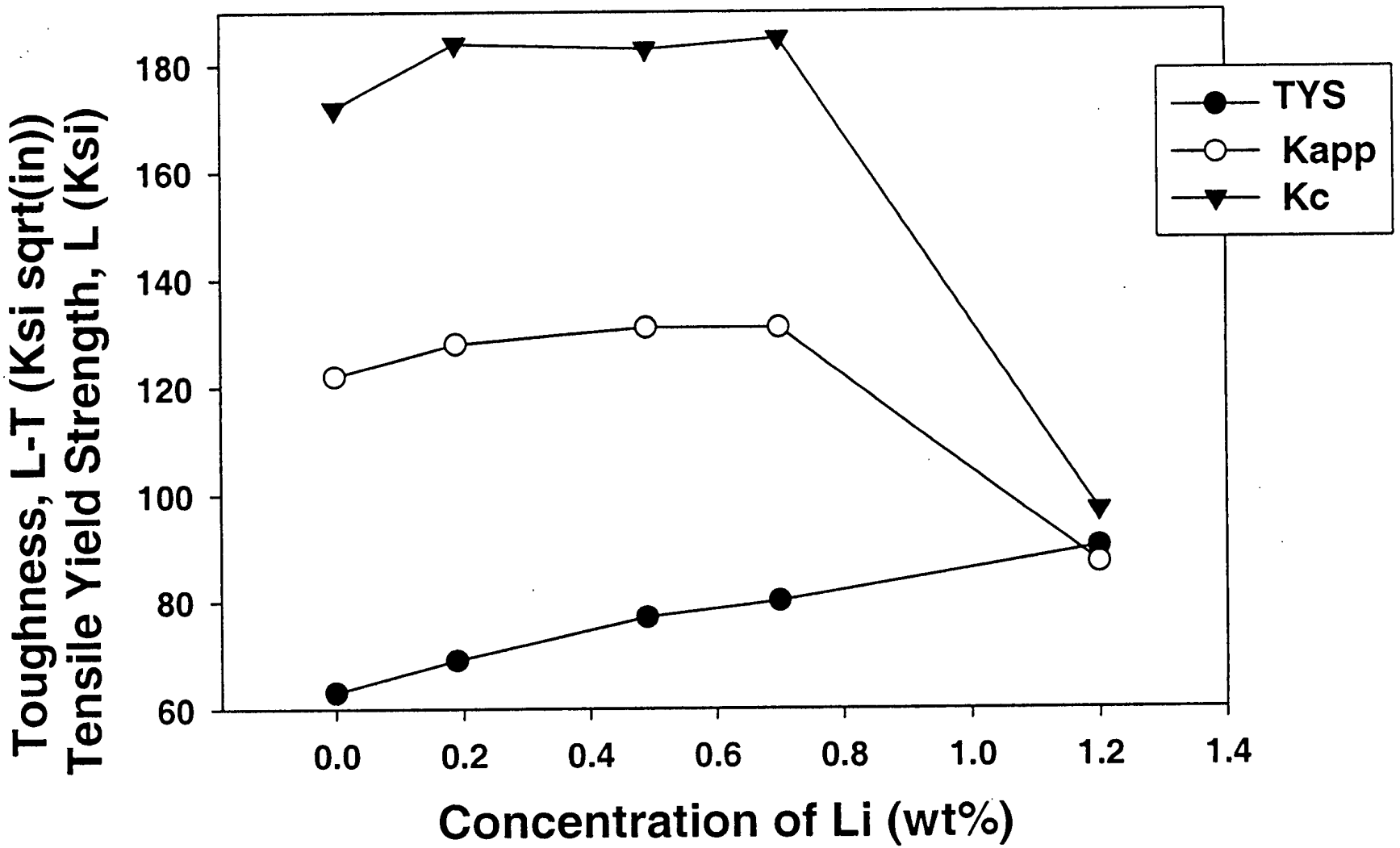
Toughness, L-T (Ksi sqrt(in))
Tensile Yield Strength, L (Ksi)
180
160
140
120
100
80
60
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Concentration of Li (wt%)
TYS
Kapp
Kc

FIG. 4

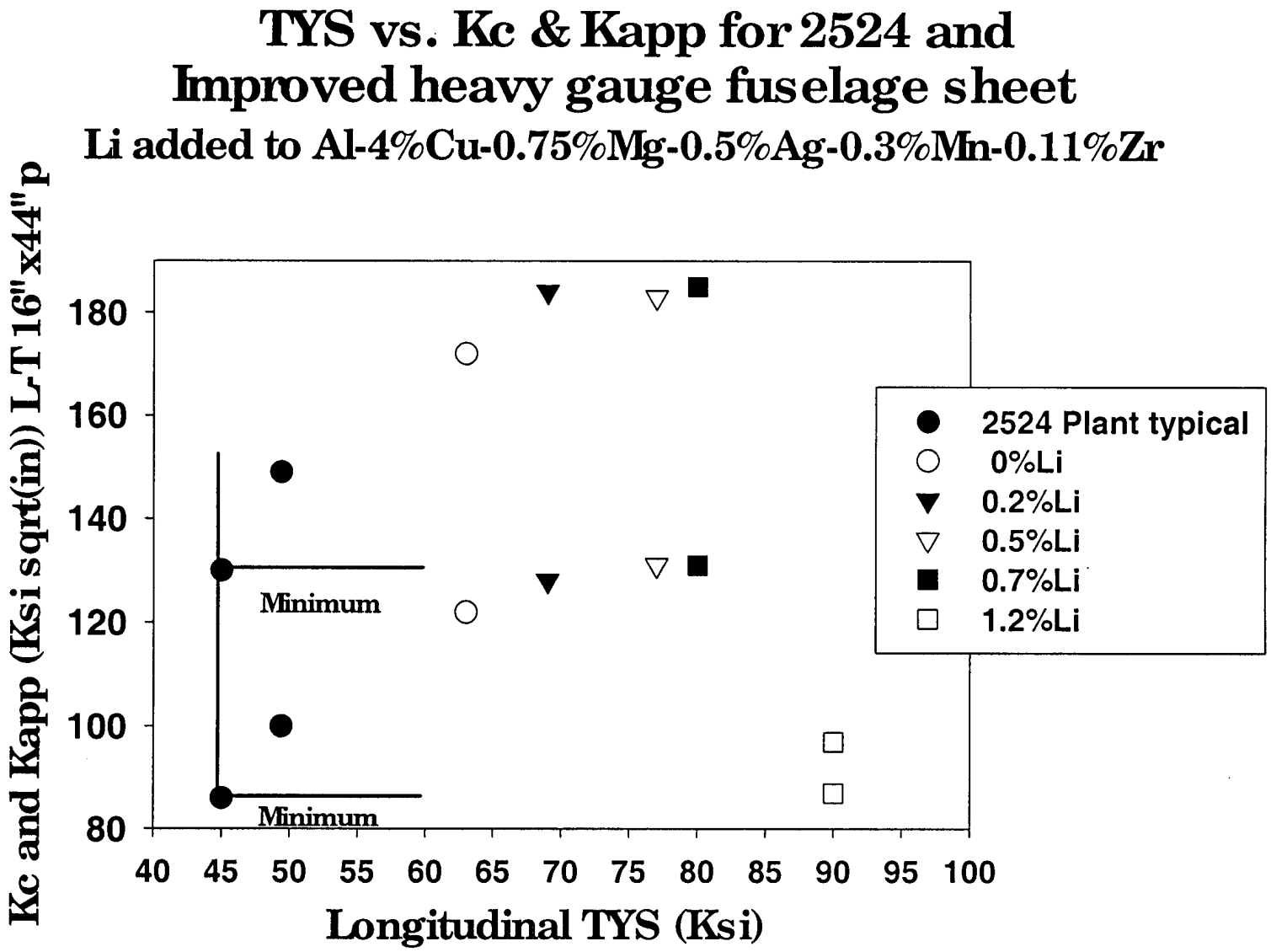
TYS vs. Kc & Kapp for 2524 and
Improved heavy gauge fuselage sheet
Li added to Al-4%Cu-0.75%Mg-0.5%Ag-0.3%Mn-0.11%Zr
Kc and Kapp (Ksi sqrt(in)) L-T 16"x44" p
180
160
140
120
100
80
40
45
50
55
60
65
70
75
80
85
90
95
100
Longitudinal TYS (Ksi)
Minimum
Minimum
2524 Plant typical
0%Li
0.2%Li
0.5%Li
0.7%Li
1.2%Li

FIG. 5

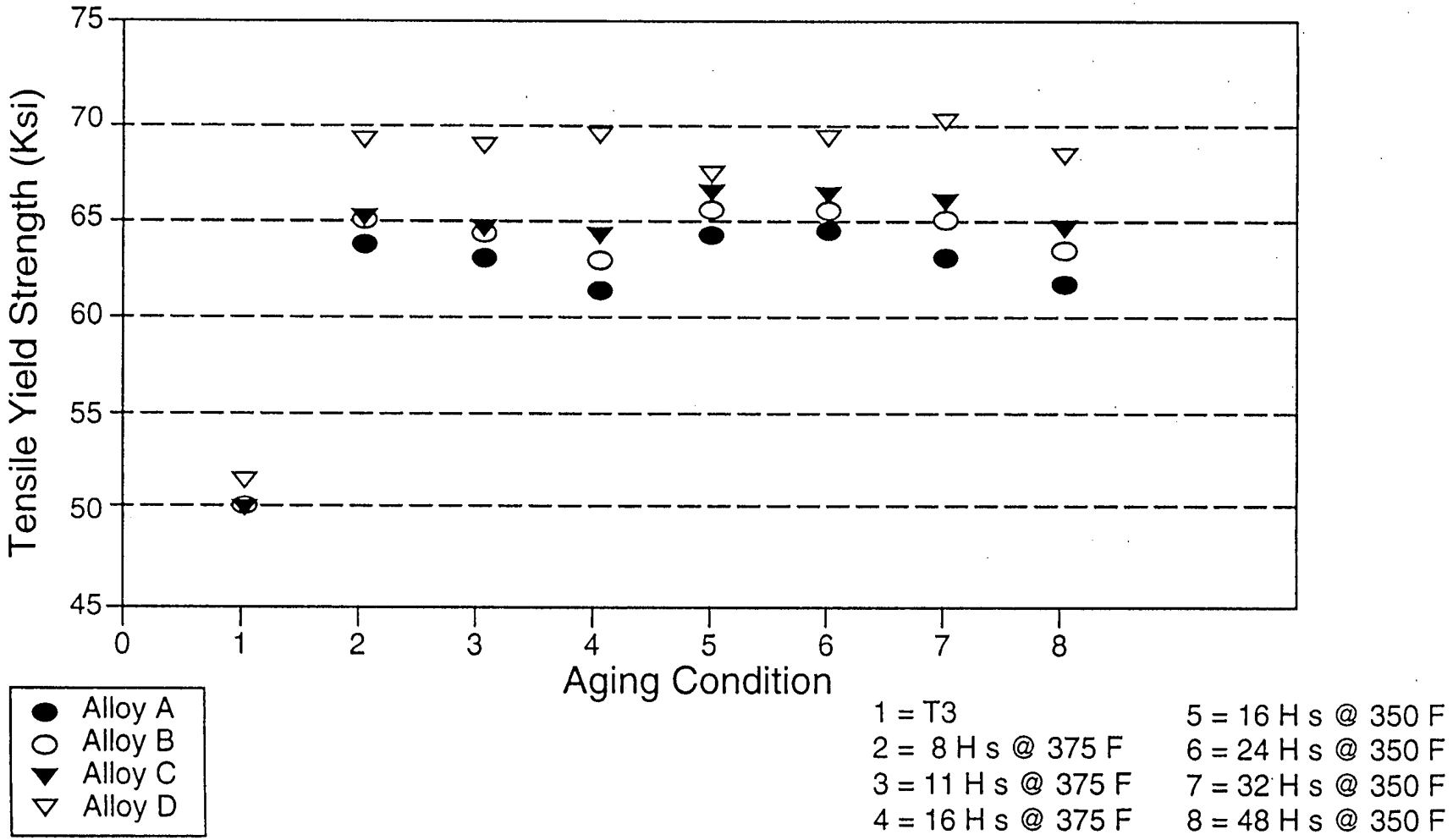
Tensile Yield Strength (Ksi)
75
70
65
60
55
50
45
0
1
2
3
4
5
6
7
8
Aging Condition
Alloy A
Alloy B
Alloy C
Alloy D
1 = T3
2 = 8 H s @ 375 F
3 = 11 H s @ 375 F
4 = 16 H s @ 375 F
5 = 16 H s @ 350 F
6 = 24 H s @ 350 F
7 = 32 H s @ 350 F
8 = 48 H s @ 350 F

FIG. 6

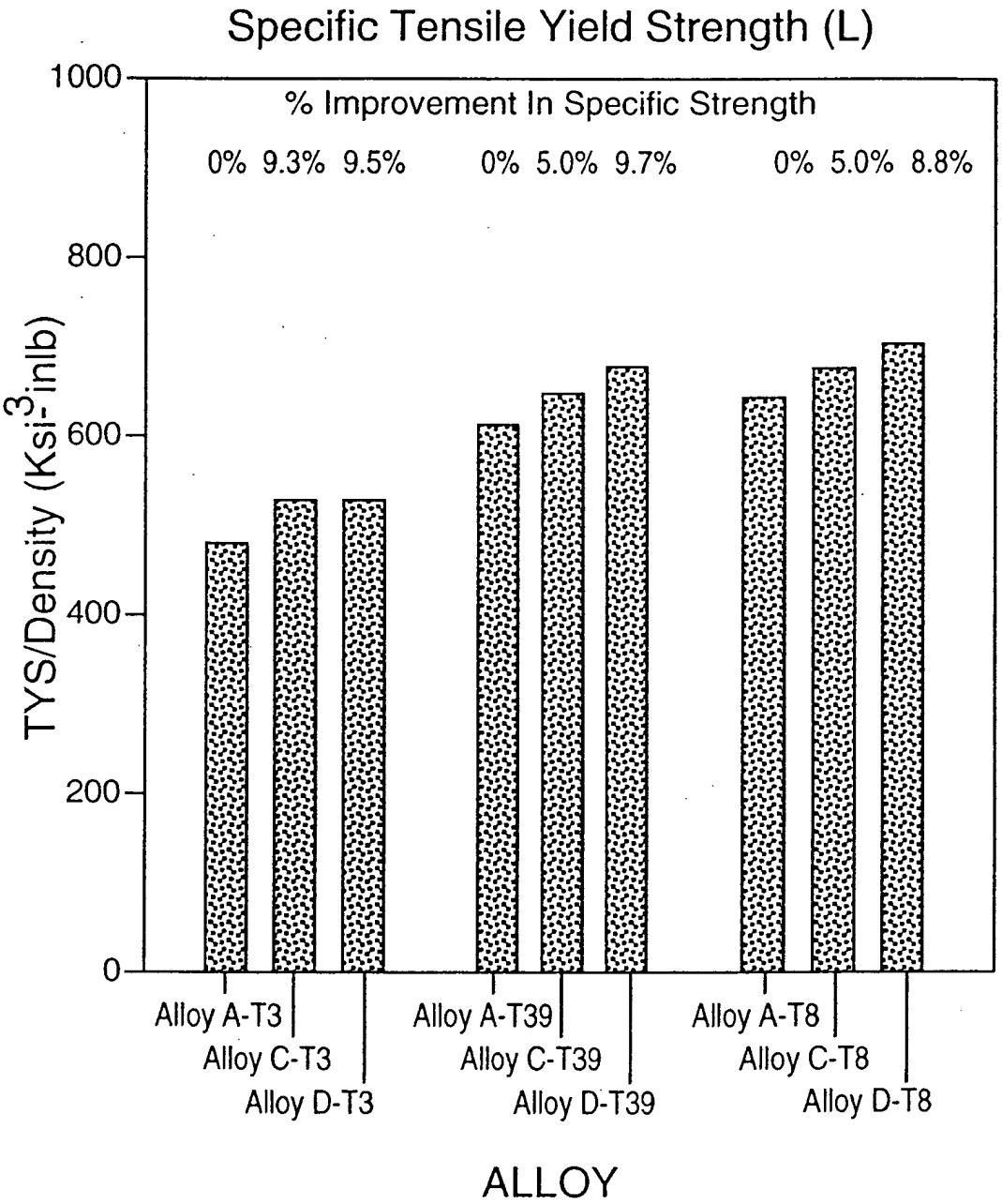
Specific Tensile Yield Strength (L)
% Improvement In Specific Strength
0% 9.3% 9.5%
0% 5.0% 9.7%
0% 5.0% 8.8%
1000
800
600
400
200
0
TYS/Density (Ksi-in3lb)
Alloy A-T3
Alloy C-T3
Alloy D-T3
Alloy A-T39
Alloy C-T39
Alloy D-T39
Alloy A-T8
Alloy C-T8
Alloy D-T8
ALLOY

FIG. 7

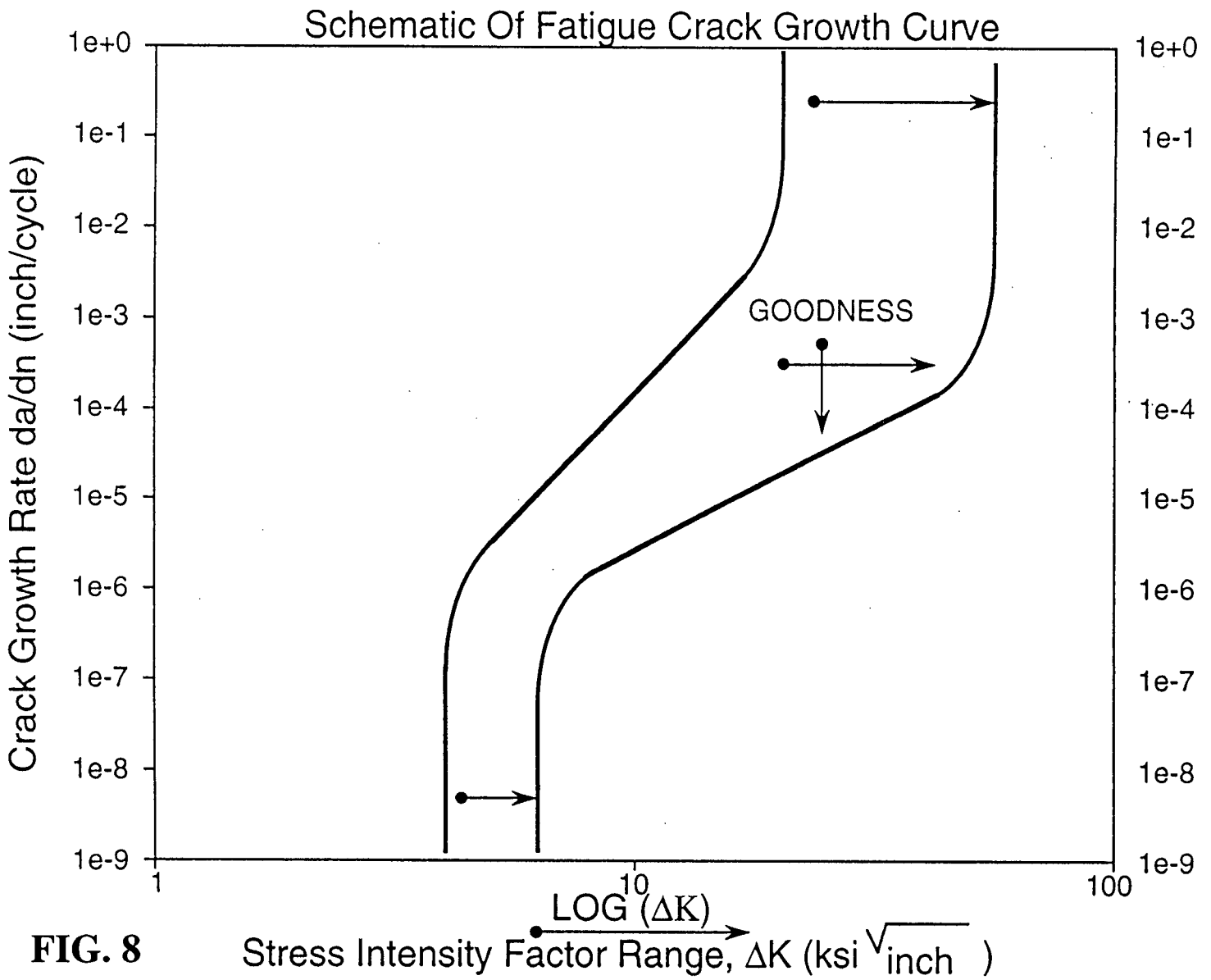
Schematic Of Fatigue Crack Growth Curve
Crack Growth Rate da/dn (inch/cycle)
1e+0
1e-1
1e-2
1e-3
1e-4
1e-5
1e-6
1e-7
1e-8
1e-9
GOODNESS
1
10
100
LOG (ΔK)
Stress Intensity Factor Range, ΔK (ksi √inch)

FIG. 8

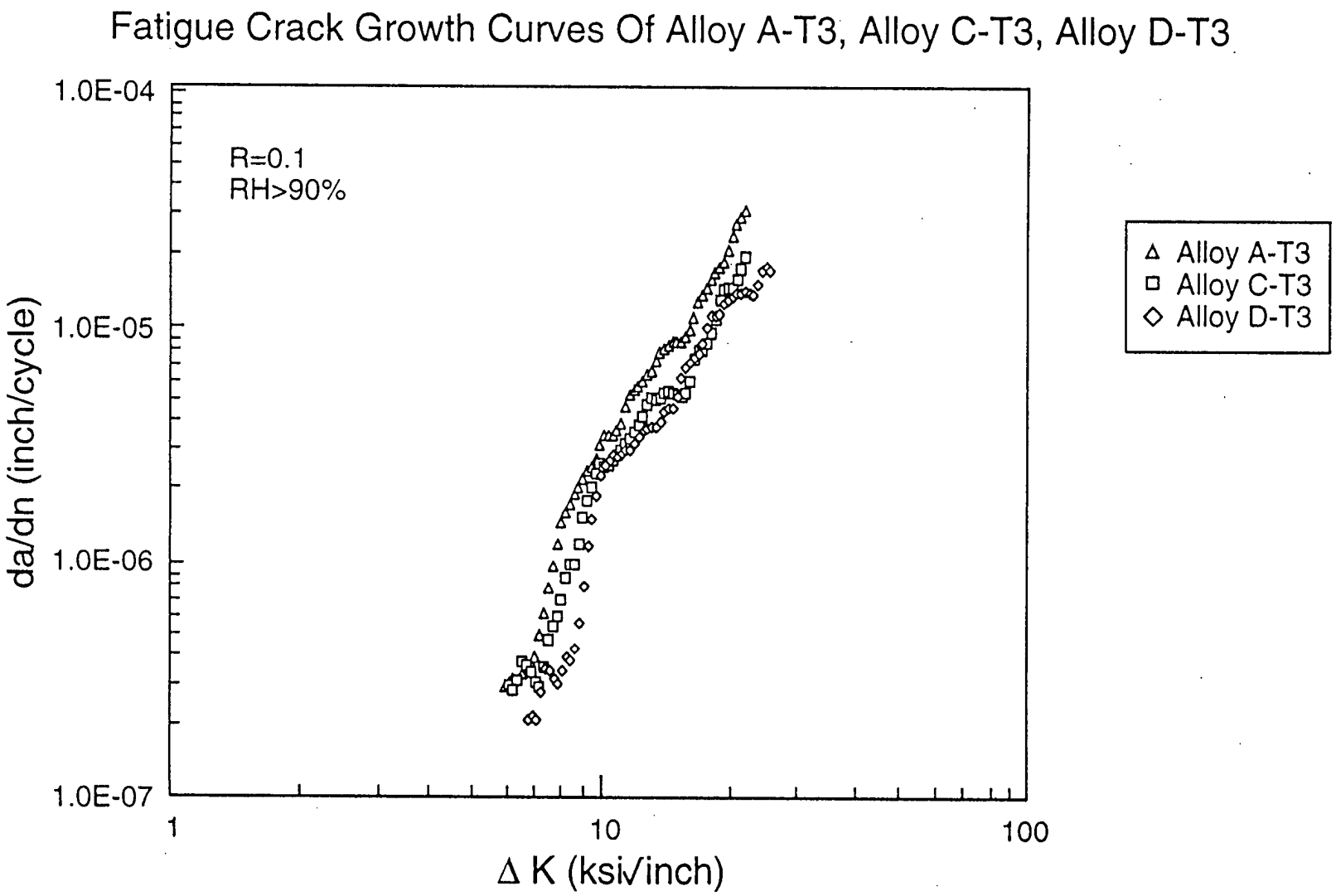
Fatigue Crack Growth Curves Of Alloy A-T3, Alloy C-T3, Alloy D-T3
R=0.1
RH>90%
1.0E-04
1.0E-05
1.0E-06
1.0E-07
da/dn (inch/cycle)
1
10
100
Δ K (ksi√inch)
Alloy A-T3
Alloy C-T3
Alloy D-T3

FIG. 9

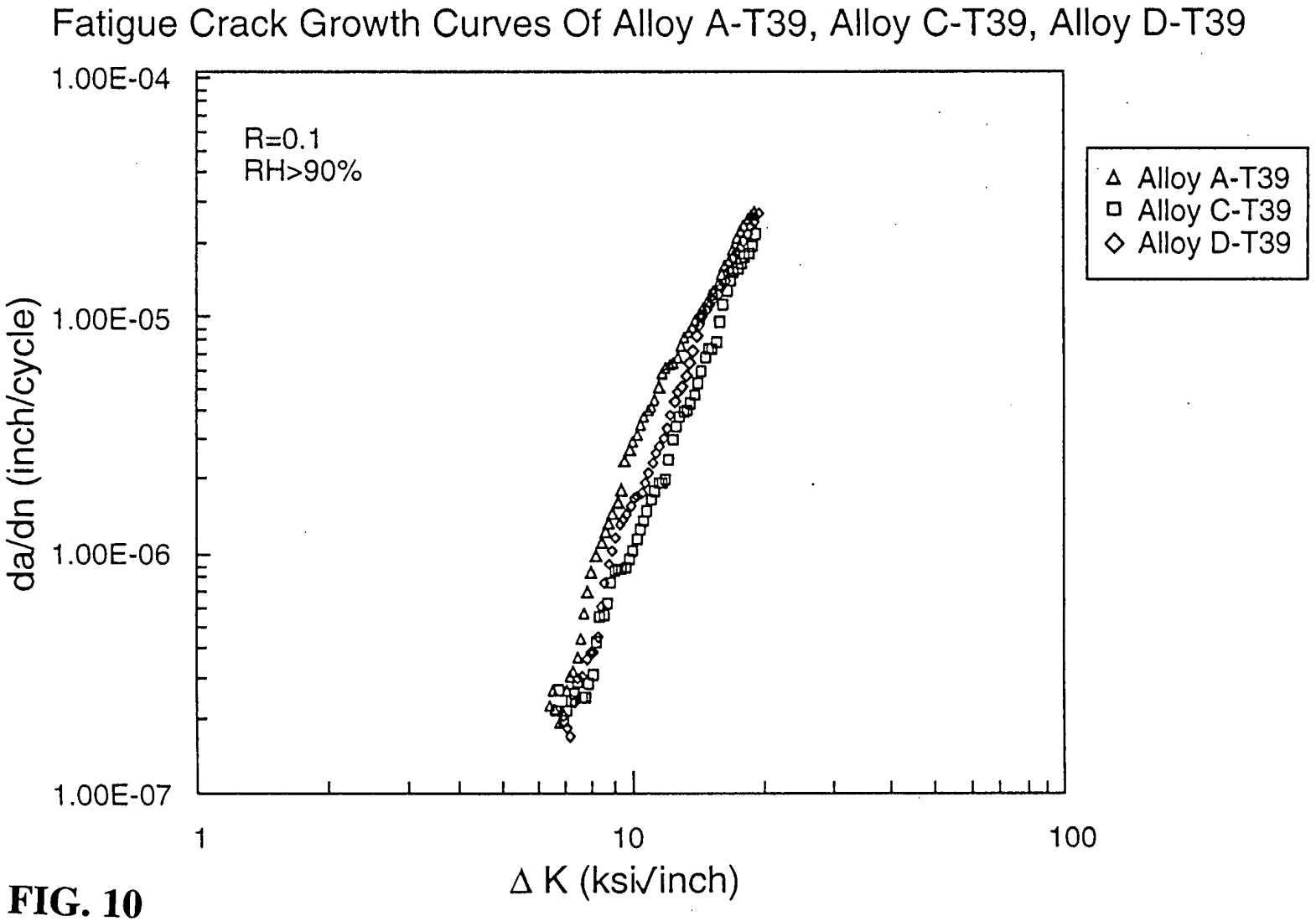
Fatigue Crack Growth Curves Of Alloy A-T39, Alloy C-T39, Alloy D-T39
1.00E-04
1.00E-05
1.00E-06
1.00E-07
da/dn (inch/cycle)
R=0.1
RH>90%
Alloy A-T39
Alloy C-T39
Alloy D-T39
1
10
100
Δ K (ksi√inch)

FIG. 10

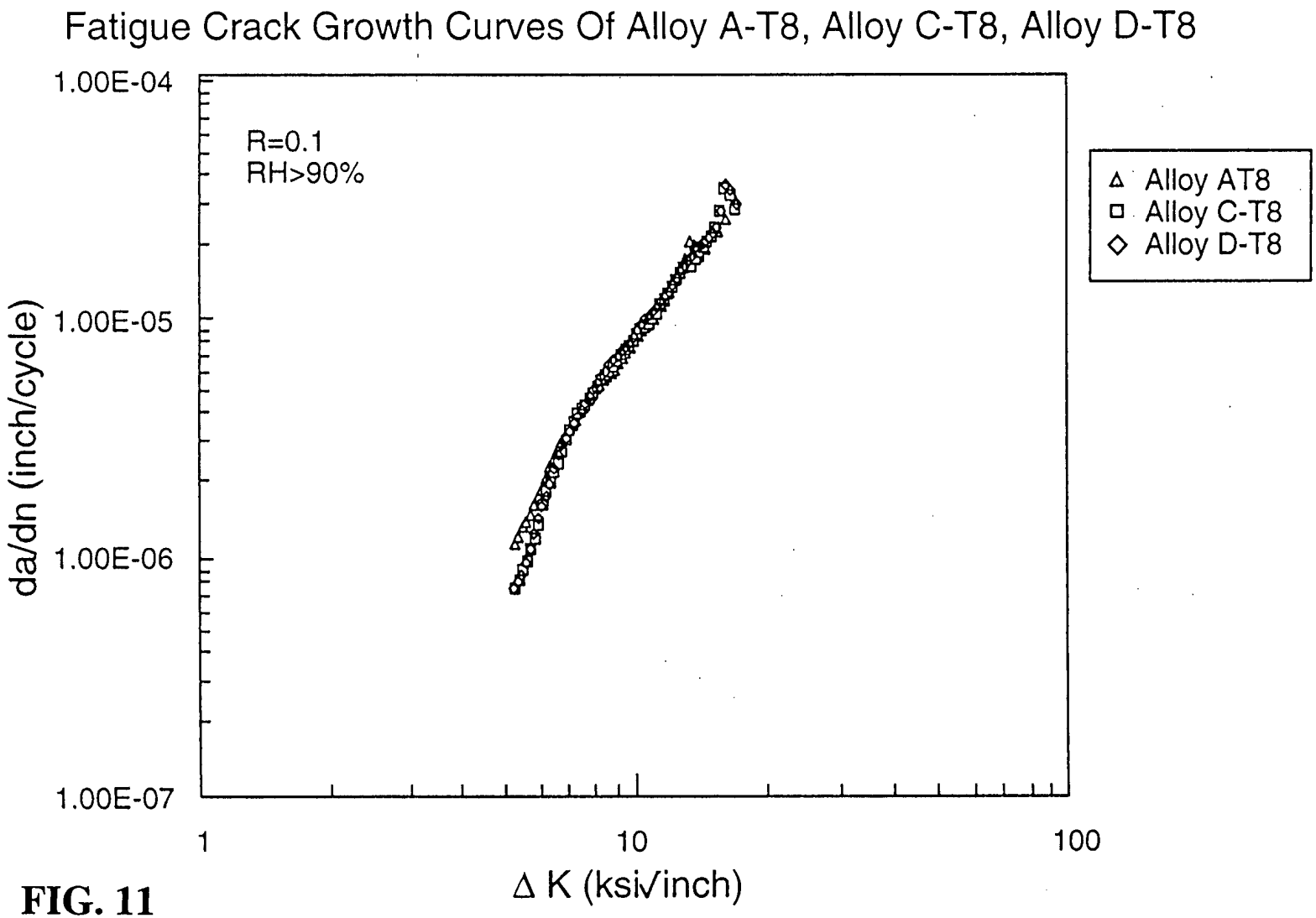
Fatigue Crack Growth Curves Of Alloy A-T8, Alloy C-T8, Alloy D-T8
1.00E-04
1.00E-05
1.00E-06
1.00E-07
da/dn (inch/cycle)
R=0.1
RH>90%
Alloy AT8
Alloy C-T8
Alloy D-T8
1
10
100
Δ K (ksi√inch)

FIG. 11

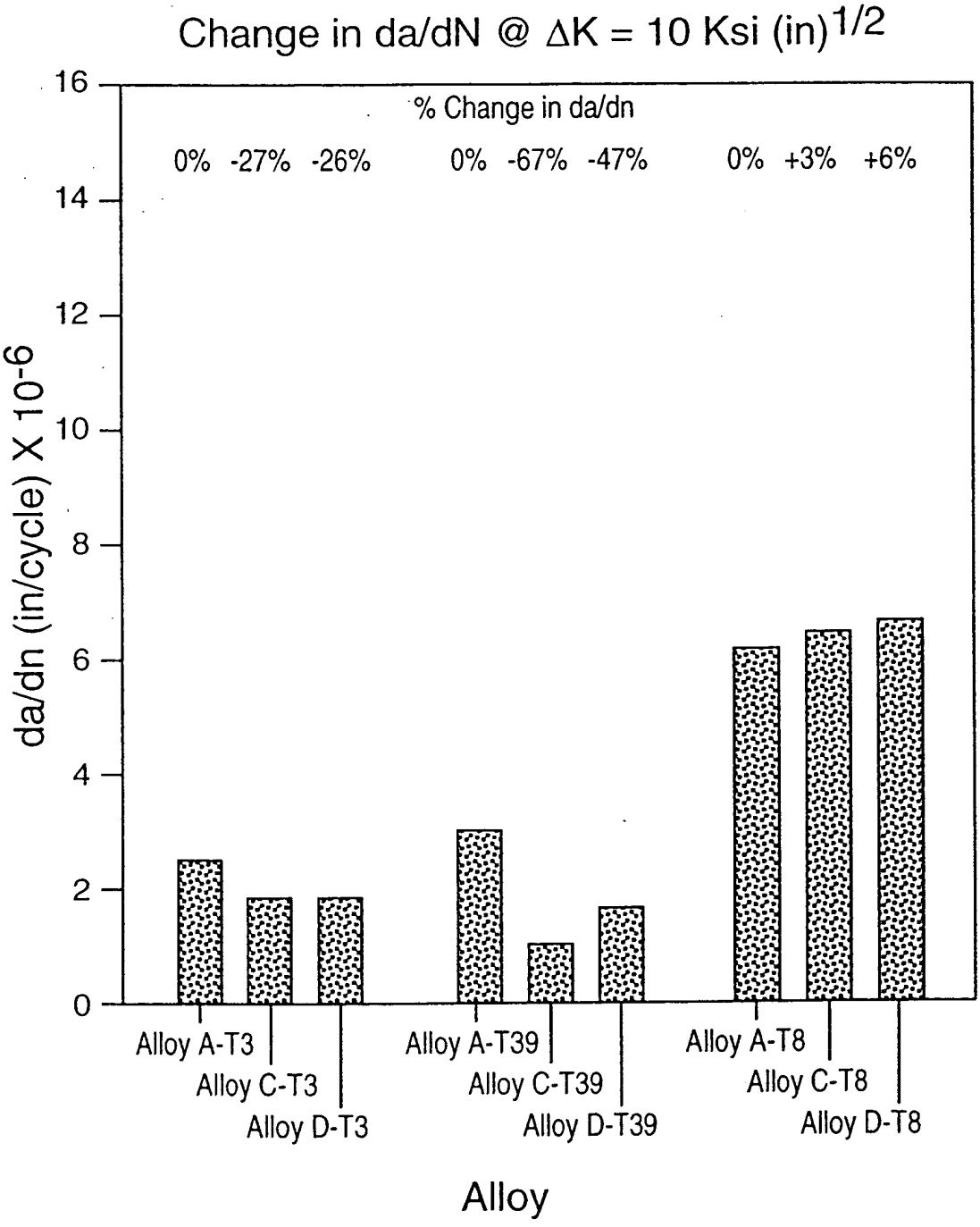
Change in da/dN @ ΔK = 10 Ksi (in)1/2
% Change in da/dn
0% -27% -26% 0% -67% -47% 0% +3% +6%
da/dn (in/cycle) X 10-6
16
14
12
10
8
6
4
2
0
Alloy A-T3
Alloy C-T3
Alloy D-T3
Alloy A-T39
Alloy C-T39
Alloy D-T39
Alloy A-T8
Alloy C-T8
Alloy D-T8
Alloy

FIG. 12

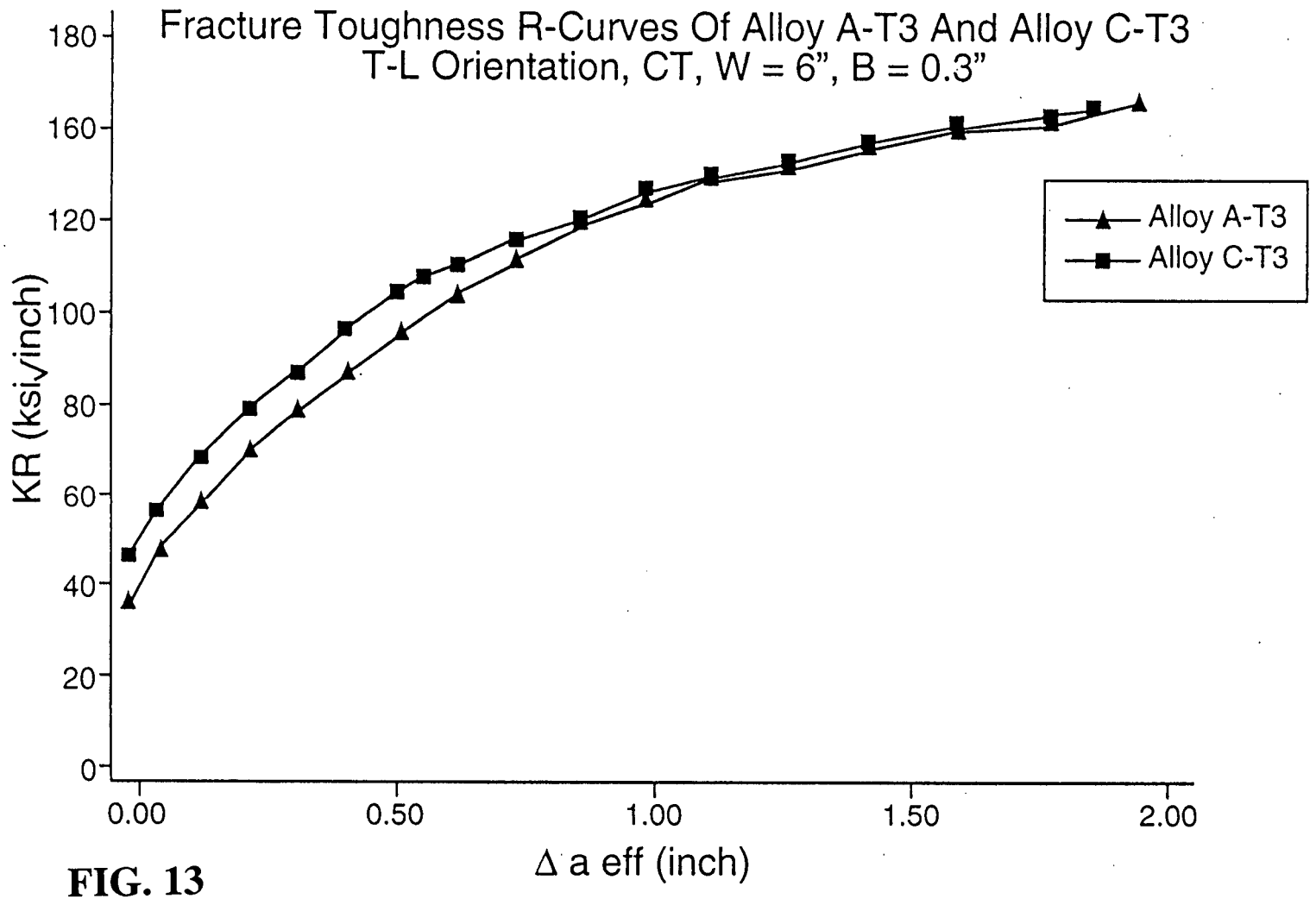
Fracture Toughness R-Curves Of Alloy A-T3 And Alloy C-T3
T-L Orientation, CT, W = 6", B = 0.3"
KR (ksi√inch)
180
160
120
100
80
60
40
20
0
0.00
0.50
1.00
1.50
2.00
Δ a eff (inch)
Alloy A-T3
Alloy C-T3

FIG. 13

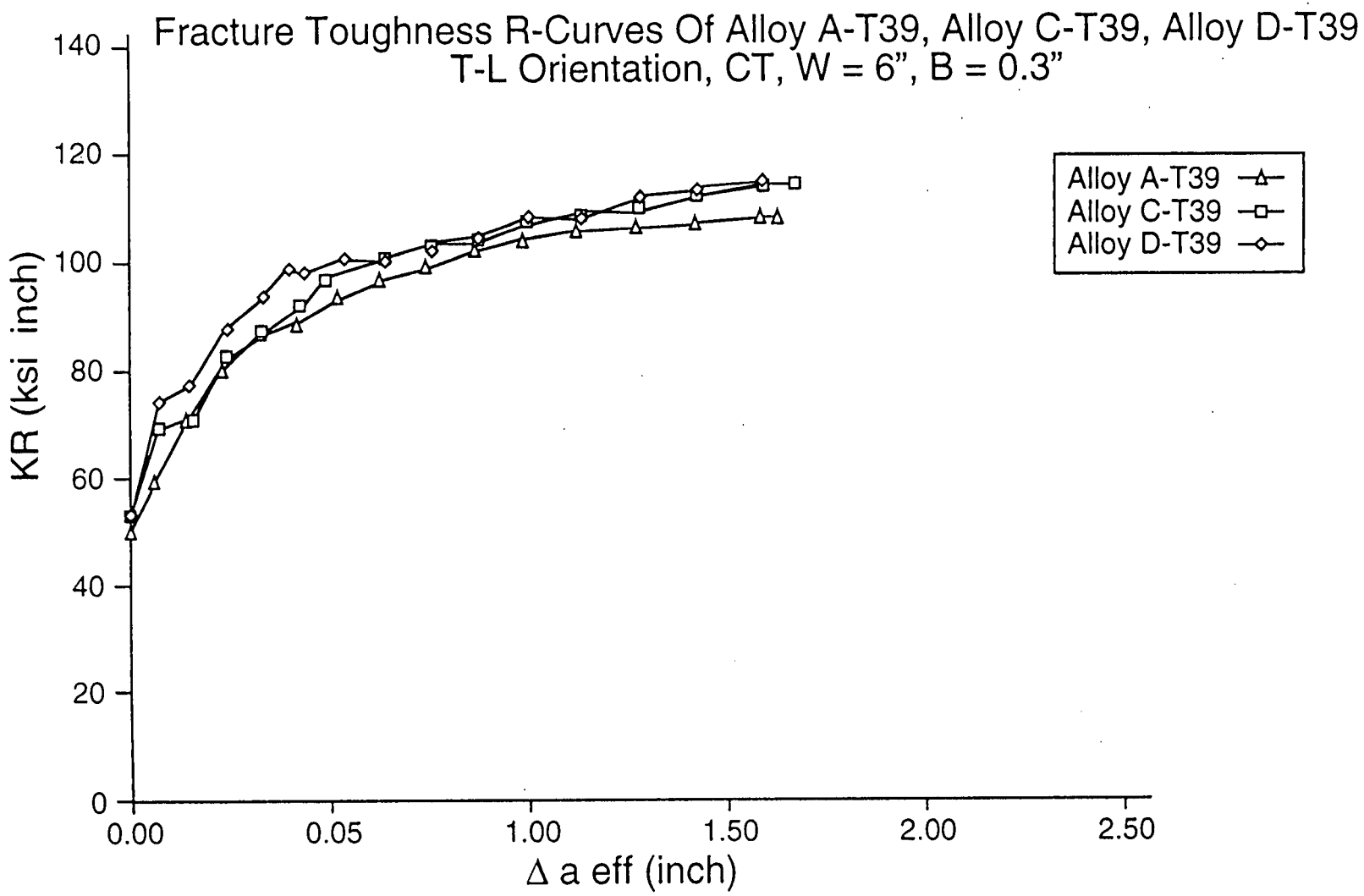
Fracture Toughness R-Curves Of Alloy A-T39, Alloy C-T39, Alloy D-T39
T-L Orientation, CT, W = 6", B = 0.3"
KR (ksi inch)
140
120
100
80
60
40
20
0
0.00
0.05
1.00
1.50
2.00
2.50
Δ a eff (inch)
Alloy A-T39
Alloy C-T39
Alloy D-T39

FIG. 14